horse-power engines will soon be erected, and will drive two Ferranti dynamos, each capable of supplying current for 25,000 lamps. These are the largest electric generators in the world, and we can get some idea of the increasing size of dynamos when we remember that four years ago the largest practical machines were Edison's 'Jumbo' dynamos of 1,200 lights capacity. In the second engine room will be placed two sets of engines and dynamos. These are combined in such a manner that the armatures of the dynamos are driven directly by the engines and act as their fly-wheels. The speed is but sixty revolutions per minute. There will be four dynamos, and they will finally have each a pair of 10,000 horse-power engines. At present they are to have but 5,000 horse-power each. All future extensions of plant will be in these units. The dynamos will weigh 500 tons, and the armatures will be 45 feet in diameter.

The distribution will be on the alternating current system. The current leaves the station at the enormous potential of 10,000 volts, and is taken to a number of distributing stations where a first conversion takes place, lowering the potential to one or two thousand volts; then it is taken to the points of consumption, where a second conversion takes place and the voltage is lowered to that necessary for the lamps.

The main cable, $2\frac{8}{8}$ inches in external diameter, is formed of two concentric tubes of copper. An insulating compound separates the two tubes, the central portion of the cable being hollow: the sectional area of each tube is .5 of a square inch.

The first two dynamos of 1.500 horse-power each are nearly completed, and will soon be erected; two of the 10,000 horse-power dynamos will probably be finished in about five months. The space now covered with buildings will accommodate 40,000 horse-power, and the rest of the space available can accommodate 80,000 horse-power more, a total capacity of 120,000 horse-power.

This station, in capacity and the enormous potential used (the maximum electromotive force is about 15,000 volts), far surpasses any thing that has been attempted in this country or anywhere else. It is hardly to be hoped that the scheme will succeed without great trouble and discouragement at first, since many of the conditions are new; but whether it finally fails or succeeds, the experience it will give will be of great benefit to electricians.

ELECTRO-DEPOSITED COPPER. — Messrs. Elmore, in England, have introduced a process for the production of pure copper tubes, wire, etc., by which very satisfactory results have been obtained. The general method of producing a tube is to immerse a revolving mandrel, nearly surrounded by bars of Chili copper, in a bath of copper sulphate, and send a current of electricity between the bars and the mandrel. The ordinary result would be the deposition of crystalline copper, with little adhesiveness and strength. The essential feature of the process is a burnisher pressing lightly on the surface of the copper, travelling on a leading screw from one end of the mandrel to the other, its motion being automatically reversed when it reaches either end. The result is a tube of great density and strength, and without lines of weakness as in ordinary tubes.

When it is desired to make wires, tubes of any desired length and thickness are cut spirally into square wires, and these are afterwards drawn to the required size and shape. The conductivity is greater than that usually obtained in commercial wire, and is even greater than that of the samples determined by Dr. Matthiessen, who used the greatest care in obtaining his specimens of copper. Tests made on annealed and hard-drawn wires give respectively 102.4 and 104.44 per cent of the conductivity obtained by Dr. Matthiessen for pure copper.

BOOK-REVIEWS.

Researches on Diamagnetism and Magne-Crystallic Action. By JOHN TYNDALL. New York, Appleton. 12°. $1.50.

WHEN Tyndall undertook the first of the researches contained in this volume, the attention of physicists had been drawn to the remarkable phenomena exhibited by certain substances, metals, and other matter, and by crystals when placed in a magnetic field. It was found that various substances, notably bismuth, were repelled by magnetic poles instead of being attracted; and it was stated that crystals in a magnetic field tended to take up a definite position, but were neither attracted nor repelled. With respect to the first of these phenomena, the questions which arose were, 'What is the nature of this diamagnetic force?' 'Does it correspond to magnetic force but with an opposite direction?' Faraday first thought that the phenomena might be explained by assuming in diamagnetic bodies a polarity the reverse of that in magnetic bodies; but he soon abandoned this view, and held that the apparent diamagnetism of bodies was caused by their being less magnetic than the medium in which they were placed. A diamagnetic body was with him a body less magnetic than air.

Tyndall, in these memoirs on the subject, has with great ingenuity, and with apparatus at once powerful and delicate, compared the deportment of diamagnetic with magnetic bodies; and "the antithesis between them, when acted on by all possible combinations of electro-magnets and electric currents, was proved to be absolute and complete. . . . No reasonable doubt, therefore, could rest upon the mind that the diamagnetic force possessed precisely the same claim to the title of polar force as the magnetic."

This work of Tyndall's was done over thirty years ago. The attention of physical scientists was called to other electrical and magnetic phenomena, and no really important experiments on magnetization were tried until 1872, when Stolltow and Rowland published their well-known researches. But in the last few years interest has again centred in magnetic phenomena, and it is well that attention should be called to earlier experiments.

The present edition of 'Diamagnetism and Magne-Crystallic Action' differs from the original in the omission of some parts that are of little interest now. As a clear description of difficult, ingenious, and successful experiment, it should form part of the library of every physicist.

Tales of the Birds. By W. WARDE FOWLER. London and New York, Macmillan. 12°. $2.50.

THIS book is hard to classify, being a series of eight fancy sketches, consisting of imaginary bird-talk, with little obvious point, and containing little that can be seriously called ornithological. It is designed, perhaps, to illustrate certain incidents of bird-life, as the hard struggle for existence of English field-fares in winter, the dangers and mishaps befalling birds during migration, etc. The birds are supposed to tell their own tales. The slight web of fact is heavily padded with light fancies, designed doubtless to interest especially juvenile readers, who may find the book somewhat attractive. The book is English in its scenes and subjects. The writer is obviously familiar with bird-ways, and might write well in a more serious vein. The eight full-page illustrations are quite in keeping with the general character of the text. The title of the book is about all that would suggest its classification as a natural-history publication.

A Manual of the Vertebrate Animals of the Northern United States. By DAVID STARR JORDAN. 5th ed. Chicago, A. C. McClurg & Co. 12°. $2.50.

THE present edition of President Jordan's well-known 'Manual' is much enlarged in scope, and so completely rewritten and rearranged as to be in many respects not only greatly improved, but practically a new work. The geograpical area is extended westward from the Mississippi River to the Missouri River, and the marine forms (excluding the deep-sea species and those of merely accidental occurrence) are for the first time included, the coast region thus covered extending from Nova Scotia to Cape Hatteras. The artificial keys of the former editions have in great part given place to analytical keys based on differential characters. While this change may render slightly more difficult the quick recognition of species by the inexperienced student, it has the advantage of making known more clearly the actual basis of classification. The order of succession of groups is also reversed, the lowest or more generalized standing first; the 'Manual' beginning with the fishes, and ending with the mammals. By the omission of synonymes and references, except in special cases, the use of smaller type and a larger type-bed, the amount of matter has been much increased, while the number of pages is lessened and the typographical appearance of the book greatly improved. In classification and nomenclature the work is fully abreast of the latest discoveries and conclusions in respect to

each of the classes treated. With its enlarged scope, more extended diagnoses, and improved keys, the 'Manual' must now prove even a more efficient and satisfactory aid to both student and teacher than heretofore, and prove fully worthy of the extended patronage it is sure to have.

Hygiene of the Nursery. By LOUIS STARR. Philadelphia, Blakiston. 8°. $1.50.

OF the many books which have been published on this subject, the one now before us is by far the best. The plan of the author has been to point out a series of hygienic rules, which, if applied to the nursery, can hardly fail to maintain good health, give vigor to the frame, and so lessen susceptibility to disease. He has done his part well, and if he shall receive the co-operation of the mothers and of the physicians, his self-appointed task cannot but result in much good everywhere, and, in many families, in a complete revolution. While Dr. Starr has evidently had especially in mind, in the preparation of this manual, the mother and the nurse, his book is one which every physician should possess. In the opening chapter the author describes the "features of health," by which term he refers to the evidences which healthy children manifest of their well-being. Of these, every mother should have a full knowledge; so that, by appreciating variations, she may anticipate the complete development of disease, and early summon skilled aid at the time when it is of most service. In speaking of the nursery, Dr. Starr says that in every well-regulated house in which there are children there should be two nurseries, — one for occupation by day, the other by night, — and that the best and sunniest rooms should be selected. The size, lighting, furnishing, heating, and ventilating of the nursery are described in detail. The qualifications of the nurse-maid are mentioned, and the author then passes on to the kind of clothing which children should wear at different periods of life. Separate chapters are devoted to exercise and amusements, sleep, bathing, food, dietary, and emergencies. We are glad to see that Dr. Starr condemns the rubber and glass tubing in connection with the nursing-bottle. He speaks of these appurtenances as "not only an abomination, but a fruitful source of sickness and death." His language is none too strong. Physicians and others connected with dispensaries and summer homes for sick children regard these tubes as intimately connected with the production and continuance of bowel-troubles, and begin the treatment of such cases by discarding the tube, and substituting a simple rubber nipple. The reason for this is, that these tubes cannot be cleansed, and the milk which passes through them becomes decomposed, and contaminates all the milk which subsequently is drawn from the bottle by the child. In the chapter on emergencies, the immediate treatment of bruises, sprains, fractures, cuts, burns, scalds, stings of insects, foreign bodies in the ear, eye, nose, and throat, ear-ache, nose-bleed, colic, and convulsions, is described, as is also the method of disinfection after contagious diseases. Taken as a whole, Dr. Starr has given the public an exceedingly practical, and therefore valuable book. His language is simple, and devoid of technicalities, and there is no portion of it which cannot be readily understood by every intelligent person.

Names and Portraits of Birds which interest Gunners, with Descriptions in Language understanded of the People. By GURDON TRUMBULL. New York, Harper. 12°.

IN some respects Mr. Trumbull's book covers new ground, its two chief objects being to provide gunners with plain, non-technical descriptions and simple black-and-white figures (woodcuts) of the birds in which they are interested, and an elucidation of the vernacular names applied to our game-birds. This latter is perhaps the true *raison d'être* of the work. The labor and time the author must have given to this phase of the subject are evidently very great, and the results are of much interest, as well as of practical utility, not only to gunners and sportsmen, for whom the work is primarily intended, but for ornithologists and philologists as well. The quaint title very fully expresses the scope and purpose of the work. The number of species treated is sixty-one, of which more than half are ducks and geese, five are members of the rail family (*Rallilæ*), nine are shore-birds, plovers and sandpipers, and five are grouse. Each species, including its various phases of plumage, is described fully in "language understanded of the people." He says, possibly with some truth, "Few, even among our most intelligent college-bred sportsmen, can form a clear idea of a bird's appearance from the 'shop-talk' of scientists, even though provided with a glossary."

About ninety very beautiful woodcuts, drawn by the well-known bird-artist, Edwin Sheppard of Philadelphia, effectually supplement the text; figures of both male and female being given, when, as among the ducks, the sexes greatly differ in plumage. The technical names are those of the American Ornithologists' Union 'Check-List of North American Birds,' and the habitats are usually given from the same source.

The greater part of the text is devoted to the common vernacular names of the various species treated, little being said about habits. While synonymy is such a bane and burden in scientific literature, Mr. Trumbull's book shows that in the case of vernacular names, which our author so delightingly collates, the number and complexity of aliases are far greater, and the unravelling of the tangled skein much more difficult; "so many names being used for more than one species, and so many having been given to one and the same bird." The pintail duck (*Dafila acuta*), for example, rejoices in thirty-one distinct English aliases, not counting numerous simply orthographic variations; while the surf scoter (*Oidemia perspicillata*) and the old squaw (*Clangula hyemalis*) have respectively thirty-three and thirty-four distinct vernacular designations. Half that number is about the rule, while the ruddy duck (*Erismatura rubida*) heads the list with *sixty-seven!* Many of these names are extremely local, and the author does well to give explicitly the localities where they are in use. "The principal reasons for this multiplication of names are obvious: viz., differences in size, shape, and color between males and females; periodical changes in plumage; mistaking one variety for another; and, more particularly, differences of opinion as to the names most appriate." In some instances a whole set of names is based on each striking feature of the bird, as of the bill or tail, or on coloration, or on peculiarities of habits. "Many of these names probably appear now for the first time in print, yet few are of recent origin; and, though some may be a little time-worn, they are time-honored, and as familiar in certain localities as 'cow,' 'dog,' and 'cat.' . . Names which appear to us absurdly grotesque and outlandish are mediums of communication between men as wise as ourselves, though educated in a different school; and the homely nomenclature of those who shoot, not alone for sport, but for their daily bread, should command respect." As already said, Mr. Trumbull's book is especially interesting from the standpoint of philology, as showing how words originate and language grows.

A very full index completes this admirable work; but a table of contents, giving lists of the species treated and of the illustrations, would also have been of great convenience.

Essays on God and Man, or a Philosophical Inquiry into the Principles of Religion. By HENRY TRURO BRAY. St. Louis, Nixon-Jones Printing Co. 12°. $2.

THIS work is written by an Episcopal clergyman of Missouri, and deals with the bearings of evolutionism and other scientific theories of the present day on the accepted doctrines of religion. The author is clearly imbued with both the religious and the scientific spirit, is thoroughly in earnest, and writes for the most part in perfect good temper. Sometimes his repugnance to certain superstitions that have gathered around Christianity leads him to use expressions that are a little rough, and those parts of the book might better, perhaps, have been omitted, as the doctrines thus attacked have already lost their hold upon thinking minds; but on the whole the tone of the work is excellent. The style, also, is simple and clear, and never leaves us in doubt as to the author's meaning. Mr. Bray's religion is based upon scientific doctrines on the one hand, and, on the other, upon all that is best in the religious teachings of the whole world. He maintains that the science of the present day is religious, and gives some quotations from scientific writers in proof of this assertion. He holds strongly to the evolution philosophy, though believing that we can know more of the divine attributes than most evolutionists admit; and he defines God as "universally extended Conscious Force." He re-